Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/779
GERMANY, FEDERAL REPUBLIC OF
February 1964
Original: ENGLISH

Confidential until official release during Conference

Abstract

Objectives in the Development of D_2O Pressure Vessel Reactors

by

A. Ziegler

Siemens-Schuckertwerke AG

The fundamental reason for the development of heavy water moderated reactors for power production is their superior neutron economy. The advantages gained thereby must, from the point of view of economy, balance the higher costs incurred. While the question whether this is possible had been discussed at numerous conferences the final answer has so far not been given. The experiences gained by us in the construction of the multipurpose reactor MZFR are apt to confirm the widely-held expectation that D_2O moderated reactors are able to compete successfully with other types. In this paper, three important aspects of the problem are discussed. On the one hand it is examined how much lower the fuel costs are than in the case of enriched fuel. On the other hand the capital investment for D_2O and a fuel load are compared with the cost of a core load for light water reactors. Thirdly the author discusses with regard to larger units, how much their investment and operating costs are likely to exceed those of light water reactors.

Hitherto, the main obstacle for the further development was generally seen in the limitation of power imposed by the restricted size of the pressure vessel. The paper examines how far the

upper limit for the power can presumably be raised by developing a pressure vessel made of pre-stressed concrete. By enlarging the vessel it is possible to reduce the neutron leakage to such an extent that, with U-233-Th as a fuel, a conversion factor above 1 can be obtained. The breeding gain will at the least be sufficient to maintain by reprocessing, after a burn-up of about 30000 mwd/t, a constant reactivity of the reactor. The breeding cycle can also be initiated with U-235 or technical Pu. It offers, under certain conditions, economic aspects for the utilisation of Pu as favourable as those of a fast breeder fuelled with oxide. Looking beyond the short-range objectives the author discusses how far the investment costs may be reduced by the admission of boiling with subsequent nuclear superheating, in conjunction with a direct steam cycle feeding the turbine. As a first step in this direction the MZFR ist now being equipped with loops for boiling and superheating experiments.